Composition and Structure of Initial Calcification of Herring and Shad Bone From Combined Micro-Diffraction and X-ray Florescence Measurements

J. Hanson, T. Koetzle (BNL), A. Lanzirotti (U of Chicago), T. Hori, M. Glimcher (Harvard)

Abstract No. hans2027
Beamline(s): **X7B, X26A**

Despite intensive investigation, the exact composition, structure and short-range order of the earliest solid phase of calcium-phosphate (Ca-P) mineral phase deposited in bone, which is directly related to its biological and mechanical functions, has not yet been established. Herring and shad fish bones provide a highly longitudinally, isotropic spatially organized whole intact bone in which one can clearly define a region free of crystals adjacent to mineralized section, the amount of mineral increasing along the length of the specimen. We have measured detailed mapping of this interface region using combined micro-diffraction and x-ray florescence. The extremely small beam (<15 micrometers) has allowed us to see longitudinal and transverse variation in the diffraction lines of apatite. Another significant observation is that no other Ca-P crystalline phases have been observed. Ruling out the main contender octacalcium phosphate (OCP) required that we measure diffraction to at least a d spacing of 25 A.

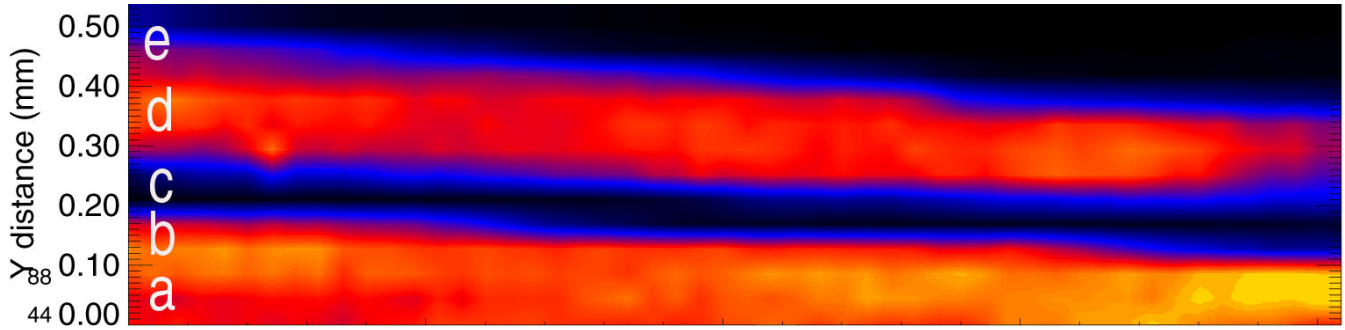

Figure 1. Strontium florescence map of shad bone. Letters mark the positions of the micro-diffraction patterns in Figure 2.

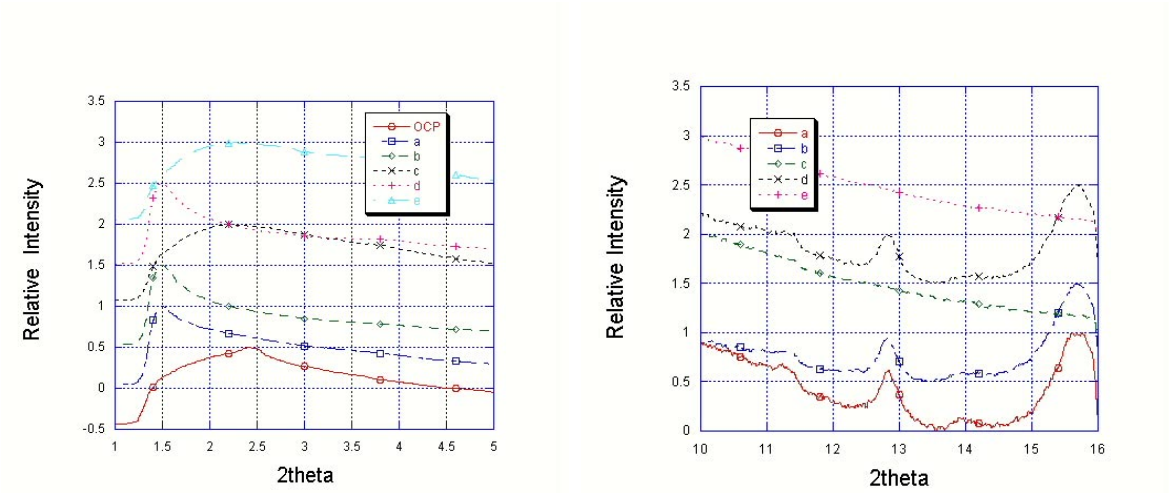

Figure 2. Micro-diffraction patterns from shad bone. Left side patterns are in the low 2Θ region where the OCP standard has a strong line(2Θ=2.5°), that is not seen in the other patterns. The right side patterns are in the region where the strong lines for apatite occur. Where the Ca florescence is weak the apatite lines are not present.